

## C. SMALL BUSINESS INNOVATION RESEARCH (SBIR)

### OSD OFFICE OF TECHNOLOGY TRANSFER SBIR FY 1997-1998 PROGRAM

The SBIR program operates by setting aside 2.5% of extramural Research, Development, Test and Evaluation (RDT&E) funds in FY 1997 to support dual use R&D activities by small businesses (less than 500 employees). In order to emphasize the importance of the OTT technology transfer mission and to encourage the defense labs to play an active role, the OSD SBIR Program funds the Technology Transfer section of the DoD SBIR solicitation. The OSD SBIR program has commercialization as a goal, therefore, projects are primarily later stage, applied research, which appear to offer the greatest possibility for near-term technology transfer "spin on" or "spin off" commercialization.

Candidate topics were solicited from Army, Navy and Air Force labs, and the OTT staff selected the most promising of the topics, based upon commercialization potential. The OSD Office of Small and Disadvantaged Business Utilization (SADBU) issued a DoD-wide SBIR solicitation 97.2, in July 1997, with a total of twenty topics in three technology focus areas. The Army Simulation, Training and Instrumentation Command is managing seven topics in the technology area of High Level Architecture for Simulation; the Naval Undersea Warfare Center is managing six topics in the technology area of Sensors; and the Air Force Wright Laboratory is managing seven topics in the technology area of Materials and Materials Manufacturing. This year 53 Phase I contracts were selected and funded at \$5 million. A technical review of the progress of each Phase I contract will be conducted by Service representatives, lab personnel and the OTT staff, in order to select those contracts with the highest potential for success under a Phase II contract. Approximately \$21 million will fund OTT SBIR Phase II contracts.

A brief description of the FY 1997 OTT SBIR topics follow, with the Service and defense laboratory identified:

***Army Laboratory Topics (OSD97-001 THRU OSD97-007) Simulation Training and Instrumentation Command (STRICOM)***

***Technology Focus Area: High Level Architecture and Data Representation for Simulation***

***Training***

***OSD97-001 Title: HLA Federation Implementation Tools***

Technology Area: The Commercialization of High Level Architecture (HLA) and Data Representation

**OBJECTIVE:** To develop new and innovative technological solutions to support the development and implementation of High Level Architecture (HLA) federation. These tools target the planning or design phase prior to any Federation operation/interactions.

**DESCRIPTION:** The need exists to design and develop infrastructure tools to aid in the implementation and use of the HLA to develop, implement and use HLA federations. These tools are desired to provide developers of simulation systems an implementation method for functionality, high fidelity, interoperability, and compliance at a low cost. These tools should address the establishment of the federation object model and the determination of the a level of

interoperation for a group of simulation applications to operate in a federation. DoD has established the process in the HLA Federation Development and Execution Process Model which lays out a general view of this process. However, objective is the development of a commercial applications, an open tool architecture is planned, with published data interchange to allow open use of DoD data resources and equivalent commercial information the use of information from a Modeling and Simulation Resource Repository is optional. The projects will establish the commercial equivalent of these data requirements or identify that they are not required for commercial applications. These tools help to establish a baseline for federation development and integration.

**DUAL USE COMMERCIALIZATION:** DoD believes that HLA is the technology thrust for interoperability. Commercial applications which desire to interoperate could use the same paradigm. The process of facilitating a federate and federation is labor intensive. The use of sophisticated tool sets which alleviate tasks and enable more efficient implementations for commercial developers are desired. Candidates for dual use include information systems management, manufacturing control, and distributed games.

***OSD97-002 Title: HLA Runtime Analysis and Monitoring Tools***

**TECHNOLOGY:** Modeling and Simulation

**OBJECTIVE:** Provide realistic real-time monitoring for the federation, or any federate, during the federation's operation. These tools support activities during federate operation and can provide feedback in after action review.

**DESCRIPTION:** This type of analysis and monitoring tool ensures proper/legitimate operation of a federation interacting over a network. This includes but, is not limited to, (two Dimensional Plan View Display, a Stealth viewer including attachment to an operating simulation) a recorder and playback capability, a federation controller, a network performance monitor and data visualization techniques eg.,. Portions of the stored data may be at different physical sites, therefore, effects of distributed recording must be addressed and supported. There have been solutions to the visualization of the simulated battlefield which partially answer the questions of the operation and health of a distributed network implementation. However, a low cost modular approach is needed for use with DoD's HLA and its commercial equivalent. The projects will review the current capabilities and evolve a flexible HLA compliant implementation which uses the federation object model, and initialization data of a protofederation or a potential commercial application.

**DUAL USE COMMERCIALIZATION:** Candidates for dual use include information systems management, manufacturing control, and distributed games.

***OSD97-003 Title: HLA Commercial Applications in Simulation***

**TECHNOLOGY:** Modeling and Simulation

**OBJECTIVE:** Demonstrate that HLA provides a commercially viable real-time simulation approach. (An HLA instantiation)

**DESCRIPTION:** Based on the constructs of HLA, establish a federation object model for a specific objective, design and integrate a commercial group of federates to perform this specific commercial implementation. The offeror should discuss the federation object model, environmental representation, and either the use of a special purpose run time infrastructure (RTI) or request the Government's RTI. The projects will use the DoD prototype developments, or can suggest alternative solutions. The use of either a commercial variant or a commercial application will help verify the validity of the HLA, and provide opportunities for novel design. This commercial application of a federation could be a real-time interactive game, a real-time management and oversight of a manufacturing facility or another commercial application.

**DUAL USE COMMERCIALIZATION:** Candidates for dual use include information systems management, manufacturing control, and distributed games in a virtual environment.

**OSD97-004 Title: *Visual Representation within the HLA***

**TECHNOLOGY:** High Performance Computing and Simulation

**OBJECTIVE:** Demonstrate realistic dynamic images for a distributed virtual gaming environment operating in an HLA environment.

**DESCRIPTION:** Using the HLA and Run Time Infrastructure (RTI) constructs and the Synthetic Environment Data Representation Interface Specification (SEDRIS) demonstrate commercial applications for high resolution displays.

**DUAL USE COMMERCIALIZATION:** Candidates for dual use include information systems management, manufacturing control, and distributed games in a virtual environment.

**OSD97-005 Title: *Stimuli (non-visual) Representation within the HLA***

**TECHNOLOGY:** Modeling and Simulation

**OBJECTIVE:** Demonstrate that HLA supports the implementation of different sensory stimuli (other than visual) in the virtual environment. This topic addresses the potential of haptic, audio, olfactory and other stimuli into the virtual reality within the HLA paradigm.

**DESCRIPTION:** Provide a novel approach which supports sensory stimulation using the HLA constructs and its environmental data. This topic provides the avenue to ensure that alternate sensory data and its representation can be supported within a federated object model, the RTI and its environmental representation.

**DUAL USE COMMERCIALIZATION:** Candidates for dual use include information systems management, manufacturing control, and distributed games in a virtual environment.

**OSD973-006 Title: *Commercialization of Components C4I Interface to Simulation using HLA***

**TECHNOLOGY:** Modeling and Simulation

**OBJECTIVE:** Many simulations require tactical intelligence information and audio communication. This topic's thrust is to develop commercial applications which use the current C4I HLA constructs.

**DESCRIPTION:** The need exists to accommodate a wide variety of real-world command, control, communications, computers, and intelligence (C4I) equipment into the synthetic environment. A primary DoD thrust for this effort is the Modular Reconfigurable C4I Interface (MRCI).

**DUAL USE COMMERCIALIZATION:** The ability to inject audio communications and intelligence is applicable to the information technology management, telemedicine applications and distributed game market, which use integrate analogue and digital signals.

**OSD97-007 Title: *Data Management/ Analysis Tools***

**TECHNOLOGY:** Modeling and Simulation

**OBJECTIVE:** Rapid reduction and analysis of federate and federation data is required. This analysis spans from an attribute level comparison through the sophisticated analysis on a simulation effect. The ability to parse data including audio and video data in a near real time analysis capability is required.

**DESCRIPTION:** There are large volumes of data used in federate and federation initialization and operation. The federation performance cannot be efficiently reviewed without automated data management tools. Analyze the effect of an additional passive federate on an exercise. These tools will allow the reconstruction of an entire federation exercise. This topic requires the synthesis of distributed recorded data, and the decomposition of the data into significant activities for replay and analysis.

**DUAL USE COMMERCIALIZATION:** There is a large community who desire rapid access and analysis of data. Techniques should support commercial information technology data management.

***Navy Laboratory Topics (OSD97-008 THRU OSD97-013) Naval Undersea Warfare Center, Newport***  
***Technology Focus Area: Sensors***

***OSD97-008 Title: Underwater Acoustic/Optical Imaging***

**OBJECTIVE:** Develop an underwater acoustic/optical imaging system or innovative sensors

**DESCRIPTION:** Combining the complementary strengths of acoustic and optical imaging technologies offers the potential to enhance the quality of underwater images required in a variety of military and civilian applications. Such combinations have been demonstrated with, for instance, ultrasonic sonar and laser line scan. This topic requests the development of innovative acoustic/optical technologies to be combined in an affordable imaging system suitable, depending on design, to such applications as hand held devices for divers, systems for unmanned underwater vehicles or stations, larger subsurface or surface craft. Projects will demonstrate the intention to develop a dual use product and an understanding of what such development entails. The objective of the topic is the development of an innovative imaging system based on innovative acoustic/optical sensors.

**DUAL USE COMMERCIALIZATION:** The system will have similar civilian and military applications such identifying underwater objects, finding environmental hazards, imaging for underwater construction or structural inspection, conducting research.

***OSD97-009 Title: High Efficiency, Broadband, Acoustic Transducers/Arrays for Various Underwater Applications***

**OBJECTIVE:** Develop reliable, simple affordable, highly efficient, broadband acoustic transducers/arrays for a variety of underwater applications.

**DESCRIPTION:** Recent developments in materials suitable for transduction and the design of multi-layer active drivers provide the potential for transducers which can satisfy military and nonmilitary applications with more versatility and more simply, reliably, and affordably than previously possible. Such materials include piezoelectric and electrostrictive ceramics, magnetostrictive alloys, electroactive polymers, and electrostrictive urethanes. This topic contains two subtopics.

**Subtopic 1.** Multi-purpose Conformal arrays. Under this subtopic, offerors should propose arrays which serve more than one function and which, if used at deep depths, are operable without a pressure compensation system. Applications (depending on frequency): close in imaging, for instance in the near surf; generation of high intensity ultrasound to effect sonochemical reactions or generate cavitation to break up and neutralize oil globules or hazardous biological waste; underwater acoustic communications; passive detection and localization of other platforms or marine mammals; acoustic communications; reduction of radiated vehicle noise and/or vibration for military or nonmilitary vehicles and vessels to increase detection ability and to provide greater passenger comfort. In the high frequency (above 20 kHz) regime, very broadband highly efficient arrays capable of handling very high power densities and suitable for versatile use in shallow water; lightweight, less powerful imaging arrays suitable for diver use. In the lower frequency regime (below 4 kHz): reversible underwater arrays for radially compact conformal mounting on the outer surface of a submersible hull, such as a Unmanned Underwater Vehicle (UUV); capable of wide bandwidth transmit, receive, and beamforming and of functioning as an actively controllable surface for radiated noise reduction below 2 kHz.

**Subtopic 2.** Low frequency projector for deep depths. Applications: acoustic tomography studies; oceanographic experiments; undersea warfare. Underwater acoustic projector capable of acoustic power output of 500 watts from 50 Hz through 100 Hz with an electroacoustic efficiency greater than 50%. Operable at depths up to 1000 meters without an active compensation system. Must be environmentally suitable to be used as an expendable source.

***OSD97-010 Title: Affordable Underwater Sensing Technology for Autonomous Underwater Vehicles***

**OBJECTIVE:** Develop affordable sensing technology on a scale suitable for integration on AUVs.

**DESCRIPTION:** Physical, fluorescence and other optical sensing technologies can now be configured for integration onto AUVs for shallow and very shallow water applications. Several sensor technologies are on the threshold of achieving the affordability, low-power, robustness, and

miniaturization needed for such applications. For Navy applications, the sensors would be housed on a 7" internal diameter autonomous swimming vehicle or on a 9" x 13.5" x 5" bottom crawler. for undersea warfare and dual use applications.

**DUAL-USE COMMERCIALIZATION:** Applications of this technology include: Tactical Oceanography for shallow and very shallow water operations; small object search and detection; environmental monitoring; mapping of sewage plumes, oil spills, hazardous waste and nuclear disaster sites; humanitarian de-mining; waste dump management.

**OSD97-011    Title: *Small, Low Power, Low Cost Beamformer for Portable Imaging Sonar***

**TECHNOLOGY:** High Resolution Beamformer Technology, Sonar Signal Processing Technology.

**OBJECTIVE:** Develop small, low power, low cost beamformer suitable for use in small high frequency imaging sonars.

**DESCRIPTION:** Advances in chip technology provide the potential for high resolution two-dimensional beamforming in a package suitable for use, for example, in a diver's hand held imaging array, in a remote imaging sonar on an unmanned undersea vehicle, or with a small surface craft sonar for obstacle avoidance. An innovative approach in beamformer technology is required to meet the size, power and cost objectives. Innovation is also required in system design to reduce high data rates generated at the array to a level compatible with a high performance signal processing which would form the images. The two-dimensional beamformer could be tested on a Government owned high resolution planar sonar array at a Government test facility. Such an array would have on the order of 100 transducer elements and thus allowing an equal number of beams to be formed. The elements would spaced at one-half wavelengths for the center frequency. The center frequency of an array of small enough size can range from 50 kHz to 500 kHz.

**DUAL-USE COMMERCIALIZATION:** Current or potential applications include use with sonar arrays for: hand held imaging systems; remotely piloted or autonomous undersea vehicles in support of cable-laying, pipe-following, and salvage; surface or underwater obstacle avoidance; oceanographic research.

**OSD97-012    Title: *Piezoelectric Ceramics for High Performance Acoustic Transducers***

**OBJECTIVE:** Develop innovative piezoelectric ceramic formulations or materials processing methods that lead to enhanced performance acoustic transducers.

**DESCRIPTION:** At the heart of an acoustic transducer lies a material that performs the essential role of electromechanical energy conversion, converting and electrical signal into an interrogating acoustic pulse on transmission, and converting the weak acoustic echoes into an electrical signal on reception. Innovations are sought in the composition of, or processing methods used to make, piezoelectric ceramics for this essential transduction task. The focus of the work lies on the materials processing, but the goal is property improvements that lead to enhanced acoustic transducers for applications ranging from Navy sonar systems to civilian underwater imaging for the detection and clearance of environmental hazards in coastal waters.

**DUAL USE COMMERCIALIZATION:** In addition to their vital role in most Navy sonar transducers, piezoelectric ceramics play a critical role in a wide range of civilian acoustic transducer applications: ultrasonic transducers for medical diagnostic imaging, vibration sensors and actuators in active noise suppression system for air conditioners and the like, and underwater imaging devices for detecting and clearing environmental hazards from coastal waters.

**OSD97-013    Title: *Automated Sound Velocity Profiler***

**OBJECTIVE:** Develop innovative, affordable, automated system, including launch and handling, for sampling the sound velocity profile in the water column.

**DESCRIPTION:** Hand launched expendable devices, such as expendable bathythermographs (XBTs) or sound velocimeters (XSVs) are currently used to sample water column properties. Recent work at the Naval Undersea Warfare Center Division, Newport (NUWCDIVNPT) has focused on possible alternative devices for obtaining the sound velocity profile (SVP). This topic seeks to explore alternative approaches. The SVP is used as input for sonar performance prediction calculations. Launching expendable devices adds to work assignments. In addition, the

environmental variability of littoral waters increases the necessity for sampling more frequently and, therefore, increases workload. Developing the technology for an automated or partially automated method for sampling the sound velocity profile without expendable devices would provide increased reliability and maintainability and decrease workload.

**DUAL-USE COMMERCIALIZATION:** This technology is applicable to the next generation Navy surface combatant and as retrofits to current surface combatants, especially in light of the Navy's goal of reduced manning. The technology can benefit commercial activities that require environmental data acquisition such as oil exploration, environmental monitoring, and power plant discharge monitoring.

## ***Air Force Laboratory Topics (OSD97-014 THRU OSD97-020) Wright Laboratory Topics***

***Technology Focus Area: Materials and Materials Manufacturing Technology***

### ***OSD97-014 TITLE: Applications of High Temperature Organic Matrix Composites***

**TECHNOLOGY:** Investigate potential high temperature organic resins that can produce organic matrix composite components by resin transfer molding (RTM) at an operating environment of 700°F.

**DESCRIPTION:** RTM is rapidly maturing as a processing method of choice to produce affordable, high quality composite components for a number of applications. Currently, the RTM resins with the highest temperature capability are bismaleimides. However, new applications require an RTM resin capable of service at higher temperatures than current resins allow. Examples of possible resin which approach an operating environment of 700°F, and also have properties amenable to RTM processing include, but are not limited to, polyimides, and phthalonitriles.

**DUAL-USE COMMERCIALIZATION:** High temperature composite materials produced by RTM are excellent candidates for turbine engine components for military and commercial aircraft. These materials may also find application as brake parts, and there are numerous potential applications for high quality, high temperature composites throughout the DoD and commercial sectors.

### ***OSD97-015 TITLE: Solvent-Free, High Tg Polymer Processing Techniques For Aircraft Canopies***

**TECHNOLOGY:** Materials, Processes and Structures

**OBJECTIVE:** Investigate, design and develop viable processing techniques which retain or improve optical transparency and impact properties for high glass transition polymers.

**DESCRIPTION:** New high use temperature polymeric materials shall be required for use in future airframes to enable the full performance characteristics of the weapon systems. Some new high temperature transparent thermoplastics have been prepared in recent years which possess glass transition temperatures (Tg's) up to 250-350 degrees C and minimum room temperature tensile mechanical values of 0.45 Msi modulus, 11 Ksi strength and 4.7% elongation to break. New manufacturing technology in non-solvent based processing techniques which retain or improve the inherent optical and mechanical properties at room temperature as well as maintain reasonable processing temperatures is sought. Typical melt consolidation above Tg and pressures of up to 100 Ksi may make for unrealistic fabrication for large commercial scale sheets compared to the state-of-the-art injection molding and extrusion devices. A model forming technique and device design is sought for proof of concept using such high Tg materials.

**DUAL USE COMMERCIALIZATION POTENTIAL:** Dual use potential exists for the successful process that optimizes low operating cost and rapid cycle with high use temperature amorphous or semi-crystalline thermoplastics. Commercial applications would include high impact resistant, high use temperature personal protective goggles and face shields, and lenses for elevated temperature environments, and flame resistant commercial aircraft windows.

### ***OSD97-016 TITLE: Materials for Rocket Propulsion***

**OBJECTIVE:** Develop advanced rocket propulsion materials and cost effective techniques for their fabrication.

**DESCRIPTION:** There is a critical need for novel, innovative approaches in the development and processing of materials which can aid the advancement of rocket propulsion technologies. For example, the year 2010 goals of the DoD/NASA Integrated High Payoff Rocket Propulsion Technology (IHPRT) Initiative cannot be met without new materials and manufacturing processes that increase performance, reduce weight, and decrease hardware and support costs of rocket propulsion systems. Specifically, goals for booster systems include: 1) increasing liquid rocket engine thrust-to-weight by 100%; 2) increasing mass fraction of solid motors by 35%; and 3) decreasing cost and time of manufacturing by 25%. New approaches will develop and characterize: (a) advanced materials that can meet these goals; and/or (b) innovative, cost effective processing techniques for these materials. Candidate materials include, but are not limited to, polymers, polymer matrix composites, metals and intermetallics, metal matrix composites, ceramics, ceramic matrix composites, carbon-carbon composites, thermal barrier coatings, and functionally graded materials. Research in this Topic is anticipated to provide a maximum of innovative flexibility while yielding promising commercial application/dual use technologies to prospective investigators.

**POTENTIAL COMMERCIAL MARKET:** Materials for rocket propulsion will transition into the US commercial space launch industry, thus enabling the US industry to more favorably compete with foreign sources for space launch opportunities through reducing the life cycle cost of inserting payloads to space orbit. Materials for rocket propulsion technologies also serve the commercial sector by enhancing our ability in remanufacture and maintenance of the US ballistic missile fleet.

**OSD97-017    TITLE: *Breathable Release Coating Development to Use on Ceramic Tooling***

**OBJECTIVE:** Develop or modify a release coating for use with ceramic tooling capable of withstanding cure temperatures in excess of 700°F. This release coating must be capable of providing both release and volatile removal for solvent based composite materials which process at temperatures up to 750°F.

**DESCRIPTION:** : The use of castable ceramic tooling for fabrication of solvent-based composite parts requiring two-sided tooling has significant cost advantages if acceptable release materials are available. Solvent based composite materials systems require manufacturing methods which allow in-situ removal of solvents. For parts which require tooling to one surface only, porous materials may be utilized on the non-tooled surface to allow permeation of the volatiles from the part. In the case of parts which require tooling on both surfaces, the tooling material itself must be sufficiently permeable to allow volatile removal and must be finished with an appropriate release coat or be inherently adhesion resistant to the composite material. For tooling materials which are not inherently adhesion resistant, the release coat must not only provide a mechanism for release of the composite part from the tool, but also a mechanism for permeation of the volatiles from the part and through the tooling material.

**DUAL USE COMMERCIALIZATION POTENTIAL:** Composite materials have already found widespread application in the commercial market. Improved quality and lower part cost are desired features whether the market is military or commercial. The concept developed herein will be applicable and beneficial to industries ranging from aerospace to automotive to medical.

**OSD97-018    TITLE: *Advanced Fasteners for Low Cost Airframe Assembly and Repair***

**OBJECTIVE:** Develop and demonstrate advanced fastener technology that will significantly reduce the cost of airframe assembly. Evaluate the feasibility of using advanced fasteners to relax dimensional tolerance requirements and substantially reduce or eliminate associated tooling cost.

**DESCRIPTION:** All future DOD weapons systems are being developed with major emphasis on achieving maximum performance at an acceptable cost. The airframe assembly operation represents a major portion of the overall manufacturing cost. Significant potential exists for lowering the cost of assembly by eliminating or reducing the need for drill tooling and pre-assembly fixtures. the development of advanced fasteners that relax hole tolerance requirements could substantially reduce cost associated with the fabrication, certification, and maintenance of high tolerance interchangeable / replaceable drill tooling.

Advanced fasteners are required that allow for loose tolerance holes and provide adequate interface for high load transfer effectively. The new fastener technology should be applicable to both permanent and replaceable fasteners. Tensile strength, shear strength, weight and configuration of the

advanced fasteners should satisfy the requirements of advanced fighters such as the F-22 or Joint Strike Fighter (JSF).

**DUAL USE COMMERCIALIZATION POTENTIAL:** This advanced fastener technology could be used to reduce the cost of commercial products such as airliners, business jets, high speed boats, etc. This technology would have wide commercial application and could be used to further reduce the cost of commercial products with mechanically fastened joints.

**OSD97-019    TITLE: *Detection of Hidden Substructure Edges and Holes***

**OBJECTIVE:** Reduce assembly cost and time by developing equipment and techniques for locating edges and holes in substructure that are hidden under exterior panels and skins.

**DESCRIPTION:** The assembly of aircraft structure involves precision alignment of skins to substructure (i.e. bulkheads, frames, spars/ribs, etc.) prior to the drilling and filling of fastener holes. All hole locations and edge distances are constrained to tight tolerances to achieve the lightest structural weight, highest structural integrity, and the lowest radar signature. Closely matched holes that fit snugly to the fasteners at the minimum allowable distance from the panel's and substructure's edge are desired. The current methods for locating holes and edges requires the assembly technician to use hard templates or to view the assembly from the underside to mark the outer skin with edge and hole location markings. Often excess material and edge distances are required to compensate for alignment inaccuracies. Low cost innovative equipment and techniques are needed that provide the assembly technician with accurate and timely information on the edge and hole locations of hidden substructure relative to mating outer skins. This information should include a visual display or markings to assist the aircraft assembly technician in drilling properly aligned holes and verifying edge distance requirements. Technologies that may apply include compact directional ultrasonics, eddy current measurements, induced thermal or magnetic imagery, laser induced acoustic emissions, etc.

**DUAL USE COMMERCIALIZATION POTENTIAL:** The ability to sense and display hidden structure would have a profound impact on both commercial and military markets. Significant cost reductions could be realized in assembly operations; which is the largest single cost area associated with the manufacture of commercial and military aircraft.

**OSD97-020    TITLE: *Hybrid Composites Manufacturing Technology - Braiding/Filament Winding***

**OBJECTIVE:** Capture the technology developed for braiding / filament winding of organic matrix composites in the Design and Manufacture of Low Cost Composites (DMLCC), Engine program (Contract F33615-91-C-5719) and integrate into a hybrid manufacturing process.

**DESCRIPTION:** Under the Air Force ManTech program DMLCC, Engine, a hybrid composite manufacturing technology has been developed involving braided and filament wound preform fabrication. The braided/filament wound hybrid composites are proving to be an effective means for fabricating critical, primary load bearing jet engine structures such as a center bypass duct. This is a straight axis part involving both braiding and filament winding with multiple features. Similar work has been done demonstrating the viability of braiding for low cost composite structures in the DMLCC, Wing program as well as in wing and fuselage structures in the NASA ACT program. Currently, the braiding and filament winding processes are done on separate machines, necessitating two machines, removal from one machine to the next, shipment to separate facilities, etc. By combining or hybridizing the two processes into a single machine, significant process improvements and cost savings can be realized.

**DUAL USE COMMERCIALIZATION POTENTIAL:** The fully integrated multi-axis hybrid preforming system would have application in a myriad of industries. In the aerospace industry, it would be ideal for the production of the center bypass duct that has been the focus of the DMLCC, E program, as well as for the manufacture of non-linear parts such as ducts and fuselage ribs. This technology would also be applicable to a variety of commercial industries such as automotive, medical (prosthetics), sports (hockey sticks, and racket sports) and recreation equipment (bicycle components).